THE SPACELAB EXPERIMENT INTERFACE DEVICE (SEID)

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The Spacelab Experiment Interface Device (SEID) has been designed and built to simulate the spacelab CDMS/RAU Interface for spacelab experiments. Its purpose is to provide a low cost method to aid in experiment hardware/software verification and spacelab/experiment interface verification.

Until recently a spacelab experimenter would have to set aside time and resources for the design and construction of a suitable interface simulator. Any incompatibilities discovered during spacelab integration could result in the removal of the experiment from the flight. The consequences of integration failure may substantially increase project cost and create unacceptable project delay.

The SEID simulates the electrical, and logical connections of the Spacelab Remote Acquisition Unit (RAU), the interface functions of the spacelab experiment computer software, and the electrical aspects of the High Rate Multiplexer (HRM).

The SEID meets ESA and NASA electrical, level, timing, drive, and loading requirements for the RAU and HRM interface. Simulated RAU interfaces include PCM serial channels (up to four), User Time Clock (UTC), flexible inputs (up to 128) and descrete outputs (up to 64). Connectors are logically compatible with the RAU.

The SEID accepts commands from any ASCII source, to execute RAU functions which are normally driven from the software resident in the central experiment computer. The commands are entered in a symbolic or a compressed format and can be executed singly or in user defined groups.

The experiment can thus be connected to the SEID, subjected to various sequences of operations and checked for proper system interface characteristics.

The SEID can be instructed to execute sequences of input/output commands to the RAU, similar to those performed during flight. This approximation of the experiment computer software is adequate to detect interface problems and prevent these from occurring during Spacelab--Payload integration.

The SEID hardware is a microprocessor based system, utilizing an 8085 microprocessor with 6K of PROM and 4K of static RAM.

SUMMARY

The Spacelab Experiment Interface Device (SEID) has been designed and built to simulate the spacelab CDMS/RAU Interface for spacelab experiments. Its purpose is to provide a low cost method to aid in experiment hardware/software verification and spacelab/experiment interface verification.

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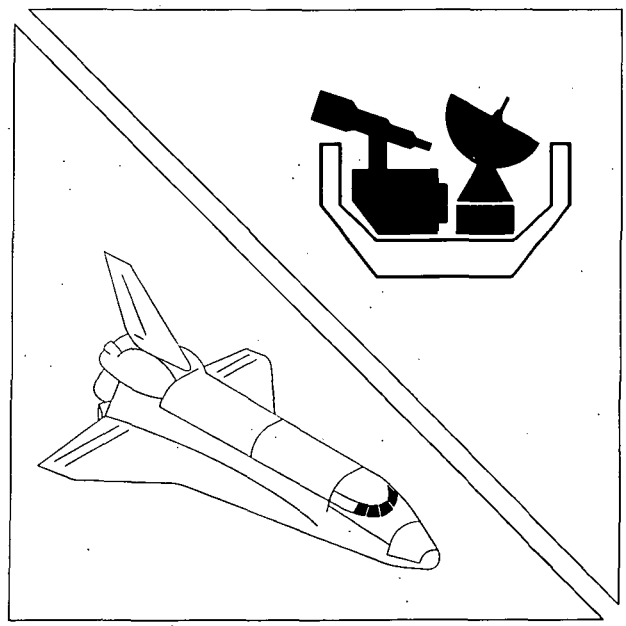
The SEID hardware is a microprocessor based system, utilizing an 8085 microprocessor with 6K of PROM and 4K of static RAM. The basic unit has been augmented with an LSI-11 microcomputer to provide disk storage and a more dynamic environment for generation of control data. A simulation of the General Monitor Loop (GML) is provided to emulate spacelab system timing.

SPACELAB
EXPERIMENT
INTERFACE
DEVICE

FOR PAYLOAD DEVELOPMENT



SEID

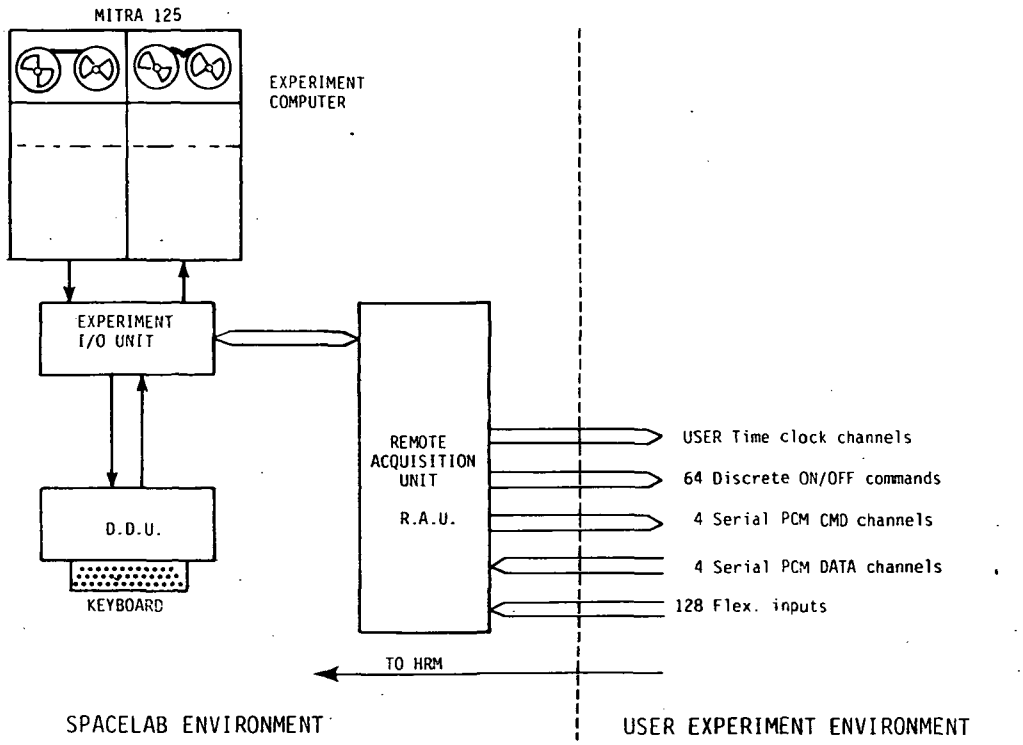
MOTIVATION

- THE PRINCIPAL INVESTIGATOR IS TOTALLY RESPONSIBLE FOR THE CORRECT OPERATION OF HIS EXPERIMENT.
- THE EXPERIMENT MUST HAVE BEEN TESTED PRIOR TO LEVEL IV INTEGRATION.
- HARDWARE/SOFTWARE ERRORS OCCURRING DURING PAYLOAD INTEGRATION MAY RESULT IN REMOVAL OF EXPERIMENT.
- LEVEL IV INTEGRATION FACILITY (OR SIMILAR FACILITY) WILL NOT BE AVAILABLE FOR INDIVIDUAL EXPERIMENT TESTING/VERIFICATION.

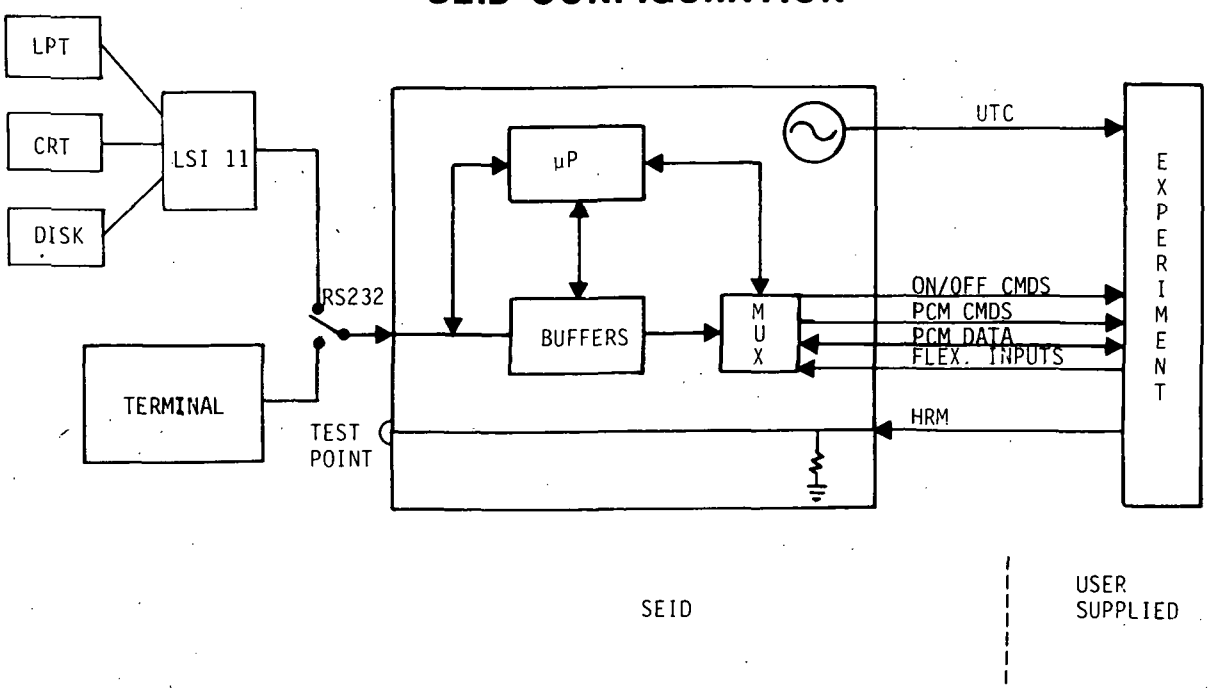
SEID OBJECTIVES

- TESTING OF EXPERIMENT HARDWARE.
- TESTING OF EXPERIMENT PROCESSOR SOFTWARE.
- TESTING OF SPACELAB/EXPERIMENT INTERFACE.
- OFF-LINE TROUBLE-SHOOTING DURING PAYLOAD INTEGRATION.
- INTERFACE CIRCUITS IDENTICAL (OR FUNCTIONALLY IDENTICAL) TO SPACELAB SPECIFICATIONS.
- ALL INTERFACE CONNECTORS FUNCTIONALLY COMPATIBLE TO SPACELAB HARDWARE.
- ABILITY TO APPROXIMATE ECOS/EAS SEQUENCES OF I/O OPERATIONS.

SPACELAB CONFIGURATION



SEID CONFIGURATION



SEID OPERATION MODES

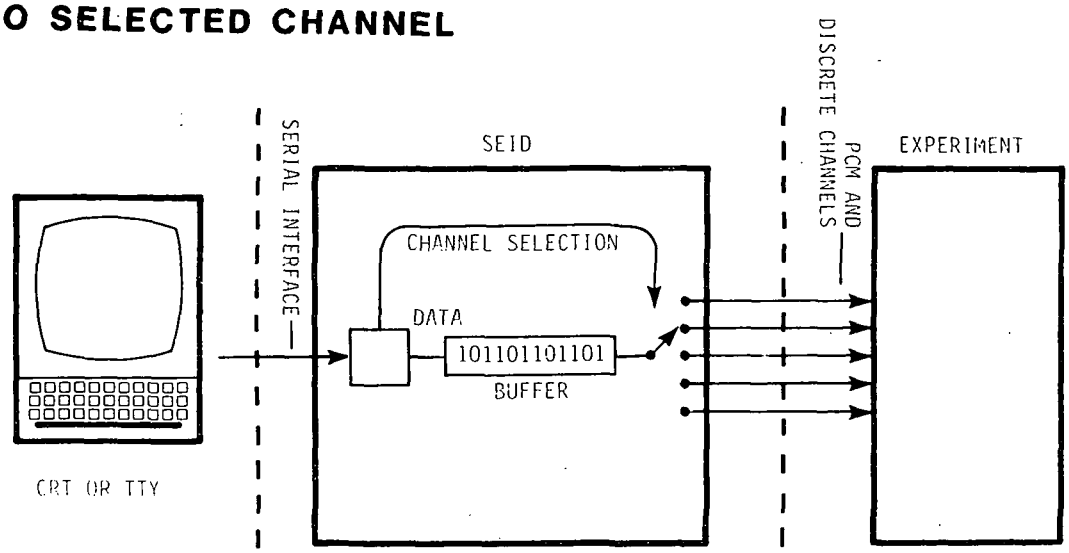
EQUIPMENT INTERFACE TESTING

SEQUENCING

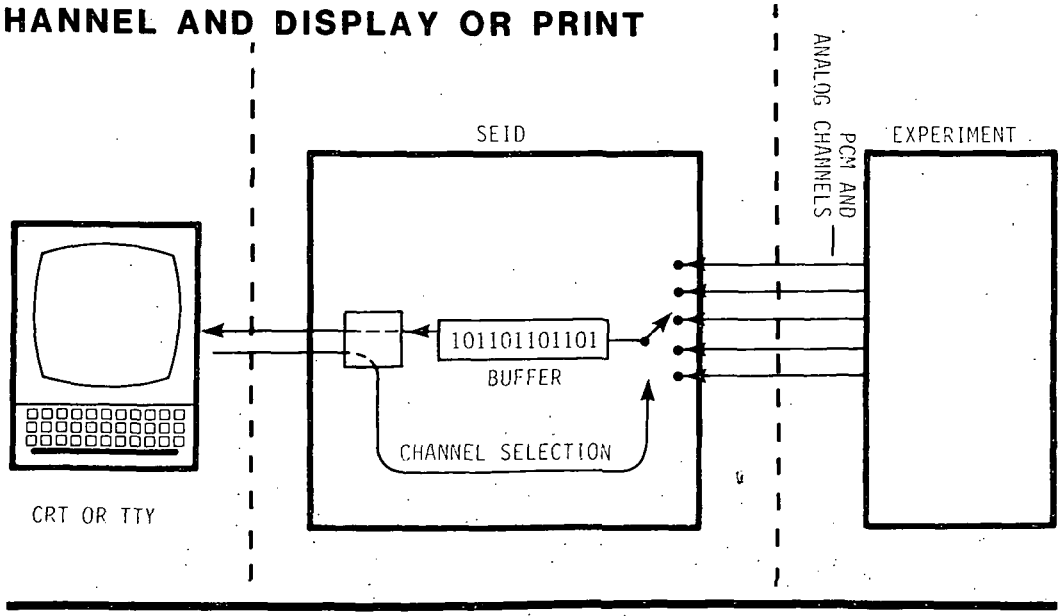
DYNAMIC REAL TIME CONTROL

EQUIPMENT INTERFACE TESTING

STIMULUS: SEND DIGITAL PATTERN TO SELECTED CHANNEL



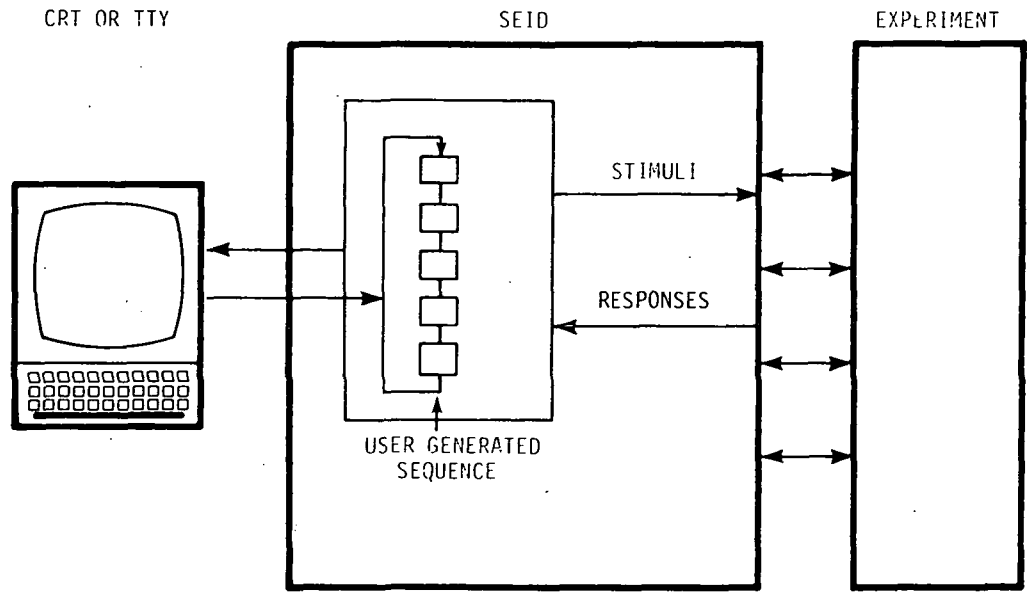
RESPONSE: READ DATA FROM SELECTED CHANNEL AND DISPLAY OR PRINT



Examples of Commands:

```
>ISSUEØ12, ON
>SENSEØ08
>READØ2
>WRITE 0, 2, 1A3F, BØØ3
```

SEQUENCING

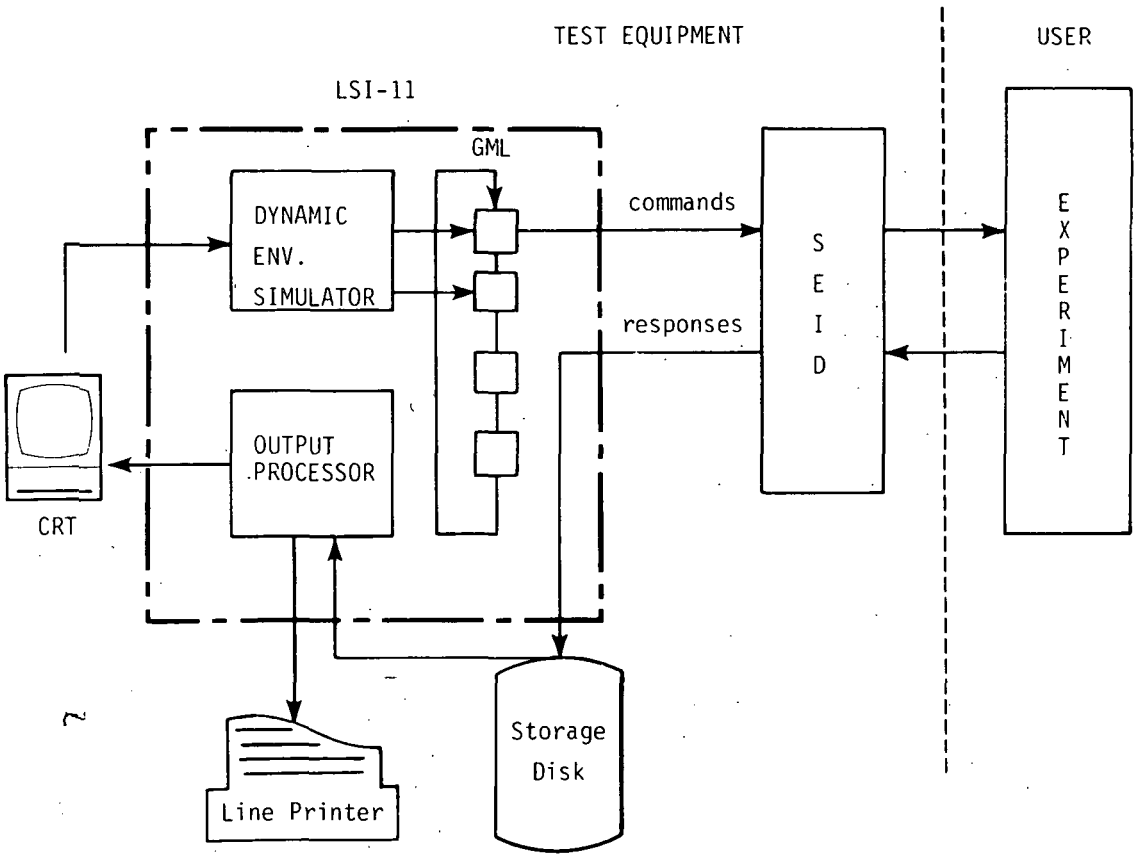


- User may specify sequences via keyboard
- The sequence can form a loop and generate stimuli and buffer responses for CRT or TTY presentation
- No external support software required

Example: ENTERING A SEQUENCE

```
> DEFINE
  seq 10 begun (echoed from SEID)
= ISSUEØ7,ON
= WAIT 3,0
= READØ2
= SENSEØ15
= STARTØ10
= ENDDEF
> STARTØ10
> STOPØ10
```

DYNAMIC REAL-TIME CONTROL



In those situations where even more computer power may be necessary the SEID can be interfaced to a user (or I^2-) supplied computer. This configuration enables the use of a GML simulation.

Example:

```
PRINT    TEST
MONITOR  ON
LOAD     TEST
PERFORM  TEST
```

SEID COMMANDS

RAU

ISSUE NN,ON (OFF)
PULSE NN,ON (OFF)
SENSE NNN
SAMPLE NNN
WRITE N,CC,HHHH,HHHH,H----
DBL-WRITE N,C1,C2,HHHH,HHHH----
READ N
SET-GMT DDD,MMMMMMMM
SET-MET DDD,MMMMMMMM
WRITE N GMT
TIME

SEQUENCE

DEFINE
ENDDEF
START NNNN
STOP NNNN
WAIT SS,MM
TYPE AAA---

DEP

LINK N
DEP-RESP N,CC,HHHHHHHH---
DEP-WRITE SS,MM
POLL-RATE SS,MM
POLL-N

SPSME

SPSME N
SISSUE NN,ON (OFF)
SSENSE NN,NN,---
SSAM-BLK NN,NN,---
SSAMPLE NN

LSI-11 COMMANDS

I/O MONITOR

MONITOR ON (OFF)
ASSIGN II,NN
END
REMOVE II,NN

SEQUENCE MANIPULATION

DEVELOP
END
SAVE NAME
DESPLAY NN,MM

SEQUENCE EDITING

INSERT NN
END
DELETE NN
CHANGE NN

SEQUENCE EXECUTION

LOAD NAME

PERFORM NAME

CONFIGURATION OPTIONS

	OPTIONS	BASIC UNIT	INCREMENT	MAXIMUM
HARDWARE	PCM Command/Data Channels and User Time Clock	-	1	4
	Discrete Outputs	16	16	64
	Flexible Inputs	-	16	128
	HRM Channels	-	1	2
	300 Baud Serial Interface	X	-	X
	110-19.2K Selectable Baud	-	X	X
SOFTWARE	SEID-RAU Software	X	-	X
	SPSME Software	-	X	X
	DEP Software	-	X	X
LSI 11/2	Front-End Controller Hardware	-	X	X
	GML Simulation Software	-	X	X

FUTURE USES OF THE SEID CONCEPT

- SHUTTLE PAYLOAD INTERFACE DEVICE:
  - PAYLOAD MDM
  - PCMMU
  - MTU

- MORE GENERALIZED TEST EQUIPMENT:
  - ANALOG, SERIAL, DISCRETE INTERFACE CIRCUITS AS APPROPRIATE